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Electrolytic Medication

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Ionization
or
Ionic Medication

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Electrolytic Medication

THEORY, TECHNIQUE *and*
CLINICAL APPLICATIONS

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NOTE

THIS little treatise is intended to be not a text book, but a concise explanation of Electrolytic Medication or Ionization, a therapeutic agent which has proven very successful in the hands of many practitioners of dentistry and medicine.

We take pleasure in acknowledging the courtesy and help accorded us in the preparation of this booklet by members of the dental profession, and desire to mention especially Dr. Harry B. Johnston, Atlanta, Ga.

We have also quoted liberally from the writings of Dr. Ernest Sturridge, London, England; Dr. George T. Fette, Cincinnati, Ohio, and Dr. Hermann Prinz, Philadelphia, Pa., whose knowledge of the subject and useful suggestions we gratefully recognize.

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THEORY

Definition

ELECTROLYTIC Medication, Electro-Sterilization, Ionic Medication, or Ionization, as the subject is variously called, is a comparatively new and valuable method of treatment in which drugs are introduced into the subcutaneous parts of the body by means of the electric current. Just how this is accomplished may not be very clear to all, so we will endeavor to explain it fully.

Molecules

All matter is composed of molecules which are defined as "the smallest particles of any substance which can exist," too small to be seen, even under a powerful microscope. If they could be seen, they of course could be divided, and therefore would not be the smallest particles in existence. These molecules are entirely separated from each other by spaces called pores, in which they move constantly in rapid vibration. The chemist, however, tells us that molecules are composed of particles he calls atoms. This need not destroy our idea of molecules, for when a molecule is broken up into atoms, the nature of the substance is changed, so it no longer exists as such.

Electrolytic Dissociation or Ionization

When a chemical substance is dissolved in water the force of cohesion between the molecules is overcome and the molecules become uniformly dispersed throughout the solvent. In the event that the molecules do not themselves dissociate or split up, we have what is known as a molecular solution. Such a solution is a *non-electrolyte* because it does not conduct the electric current. An example of this would be common sugar water. If, however, in the act of dissolving, the molecules themselves split up into the atoms or radicals of which they are composed, then the solution is said to be an *electrolyte* because, upon trial, it would be found to be capable of conducting the electric current. Now this phenomenon of the molecules splitting up into their particles is called *electrolytic dissolution* because the particles, as Arrhenius discovered, contain electric charges, one positive and one negative for each molecule thus dissociated, or multiples of them, for example, $KI — K^{+} + I^{-}$; $Zn\,Cl_2$ $—\overset{++}{Zn} + {}_2\overset{-}{Cl}$.

Ions

It is these electrically charged particles which conduct, and move along with the electric current. These moving particles were called *ions* by Faraday, indicating by the term, something "going or moving." Now since these ions are formed in the very act of the molecules dissolving, the phenomenon is also called *Ionization*, so that ionization and electrolytic dissociation mean absolutely one and the same thing. Why the ions take on electric charges in the absence of any electric current is explained by the fact that they represent a different amount of chemical energy from the atomic form which they had in the undissociated molecules—the amount of the difference being the equivalent which could be obtained from the system as electricity.

Electrolysis

An electric current has the power of decomposing or splitting up some compound substances such as chloride of zinc. This process is called electrolysis, but how is the process to be understood? We saw that KI, dissolved in water, is split up, or ionized into K^{+} and I^{-}. If we can remove those electric charges from the potassium and iodin ions set free, metallic potassium and free iodin would be obtained. This is precisely what the electric current does; it neutralizes those charges on the ions by its own positive and negative nature. Where or in what part of the system is this neutralization effected? We say on the electrode surfaces and only those ions are set free which come in actual contact with the electrodes (on this depends the principle of electroplating). Now in proportion as the ions in contact with the electrodes are set free, in the same proportion other ions move up and come in contact, to be in turn set free.

Ionic Migration

This causes a movement in constant direction of all the ions included between the positive and negative electrodes; this movement or transport is known as *ionic migration.* We now note particularly that electrolysis and ionic migration are inseparably associated facts which we express summarily as an electrolytic process. We cannot have the one without the other and both are impossible where ionization (molecules dissociated into ions) has not been previously had. We readily understand now why in order to have migration of iodin ions (which is the germicidal ion) we must necessarily have electrolysis at the electrodes. If water is subjected to the electric current the products of electrolysis will be hydrogen and oxygen. At the positive pole will be given off oxygen and at the negative pole hydrogen, and between the two poles there is simply migration of hydrogen and oxygen ions, disregarding secondary changes which cannot be discussed here.

When a compound is split up into ions (electrically charged atoms) the ions become positively and negatively charged, and those which are positively charged are repelled by the positive pole and are called electro-positive, and those which are negatively charged are repelled from the negative pole and are called electro-negative.

In considering this it is well to bear in mind that a direct current of electricity always flows from the positive to the negative pole, so in selecting ions for ionization treatments, they must be chosen with due regard to the direction in which they will migrate, in other words, ions must be chosen which will migrate from the positive pole toward the negative pole, if the former pole is applied to the part to be treated, or vice versa if iodin is used.

Ionization

A more appropriate name is Electrolytic Medication, suggested by Dr. George T. Fette, of Cincinnati, Ohio, meaning medication or sterilization produced by means of electrolysis the theory of which has just been explained. In decomposing water into its elements, by passing a current of electricity through it, using two electrodes, positive and negative, the products of electrolysis or electrolytic action set up are oxygen and hydrogen, and as oxygen ions are electro-negative, they will be repelled from the negative electrode passing through the water to the positive electrode where they will appear in the form of bubbles. Hydrogen ions, being electro-positive, will appear at the negative electrode, and their charges being neutralized will come off as a gas.

In Ionic treatments the tissues of the body take the place of the water and by applying a solution containing antiseptic ions to the surface of the tissue at the positive electrode, electrolysis takes place, the electro-positive ions being repelled from the positive electrode, migrate into the tissue endeavoring to reach the negative electrode, the same as the hydrogen ions passed through the water to the negative electrode. It must be evident, then, if antiseptic solutions are of value for treating surface infections electrolytic treatments must also be of value for reaching organisms lurking beneath the surface, and out of reach of antiseptic lotions, for from clinical evidence at hand, we can at least feel sure that ions can be driven in, to a sufficient depth to make them useful in treating conditions beneath the surface. Metallic ions will be repelled from the positive electrode, and non-metallic ions from the negative electrode, then the metal (or non-metal) will migrate into the tissues. The highly antiseptic properties of iodin (non-metallic) ions are well known.

Electrolytic Medication must not be confused with the therapeutic treatment formerly quite extensively used by dentists and known as Cataphoresis, this is based on the laws governing osmosis which involves the movement of suspended molecules en masse by means of the electric current, and electrolysis plays no part in these treatments.

TECHNIQUE

UNTIL comparatively recently there has been a great deal of uncertainty and division in the ranks of the profession as to just what could be accomplished in sterilization by electrolytic medication. This process has had many staunch friends over all its years of use and there have been many other men of high reputation and great learning who have condemned this treatment. This is not surprising when we consider that until a very few years ago electrolytic medication was used quite empirically. Very little scientific evidence had been submitted to the profession as to just what could be accomplished by it; the best method of accomplishment of definite results; duration of each treatment; time which should elapse between treatments; the amount of current which gave the best results; the amount of resistance to the current by the tissues; and the electrolyte or solution to be used. These points covered all of the main factors in the intelligent and successful use of electrolytic medication and it can be seen that until each has been positively determined, definite results could not be expected.

Old Methods Empirical

Like most methods of treatment which are of established value, this treatment has been of slow development but its merits are now known and the method of application has been worked out on a much more scientific basis, each step having been proven both clinically and experimentally. The first error in its application was that of using solutions which were simply electrolytic and contained little if any germicidal properties and were correspondingly low in therapeutic value inasmuch as the object of its use is solely destruction of pathogenic bacteria. The solutions commonly used in the early days were sodium chloride and zinc chloride. Laboratory experiments with these two solutions proved highly unsatisfactory from a germicidal viewpoint but clinically proved of decided benefit in many cases. In the opinion of some authorities this benefit was produced principally by the flow of the mild galvanic current through the diseased area, thereby producing a stimulation of the blood supply which would probably best be classed as a psychological hyperemia and possibly a temporary inhibition of bacterial growth. In those cases in which the natural resistances of the patient was almost sufficient to overcome the infection, this slight help was often sufficient to throw the balance in favor of its elimination. More than this was desired, however, and believed possible by many who had carefully studied electrolytic medication and this faith began to bear fruit when it was found that iodin was available for this treatment. This was first used in the form of a solution of potassium iodin which proved to be a marked advance, but still did not measure up to the accomplishment which had been set for it. This gave the idea that if solutions containing more iodin were used results might be still further improved. Dr. Geo. T. Fette of Cincinnati, Ohio, then recommended the use of Lugol's solution, which completely revolutionized results. By this time, however, the use of electrolytic medication had come to a very low ebb—many experimenters becoming dissatisfied with it because of not using proper solutions and had discontinued their experiments and its use. This led to the belief that the larger percentage of free (available) iodin contained in the solution, the greater its effectiveness inasmuch as there were more iodin ions ready for conveyance by the current in the diseased part. Acting upon this idea, Dr. Harry B. Johnston of Atlanta, Georgia, carried out a great number of experiments with Churchill's tincture of iodin which contains sixteen per cent of free iodin. Results, as was proven by bacteriological investigation, were still further greatly improved. This solution contains two and one-half per cent potassium iodide which is sufficient to make it strongly electrolytic and gives an electro-chemic activity greater than that secured by any other solution yet spoken of by any authority. The use of this solution with proper technique appears to have placed ionization in its proper position for dental use. Both experimentally and clinically, this treatment has proven to be absolutely destructive for all the forms of bacterial life commonly encountered about the apices of apically infected teeth.

Dr. Johnston's Experiments

Dr. Johnston describes his experiments as follows:

"I first used Churchill's tincture of iodin clinically. It would be interesting to describe the first two cases in which I used it. The first was that of a girl; thirteen years old; right lower first molar; gave a history of chronic periapical abscess on both roots from which pus had flowed through the tooth for three months. The case was given three ionizations, using zinc chloride—one milliampere of current for fifteen minutes with intervals of three days between the treatments. No noticeable results were obtained from these treatments. The tooth could not be sealed for more than an hour. Churchill's tincture of iodin was then tried, giving the same duration of treatment and strength of current and the canals immediately filled. To my surprise, when the patient reported next day, the tooth had been entirely comfortable and there was no evidence of pus formation. The coronal restoration was immediately made and the tooth has been a perfectly safe and satisfactory masticating organ for about six years.

"The second case was very similar—being that of a boy 14 years old; left lower first molar; a drainage of pus for approximately four months; treatment by several dentists; three ionizations with zinc chloride proved entirely ineffective. The same treatment was given, as was in the first case, with identical results.

Laboratory Experiments

"Laboratory investigation was then undertaken and by securing from my friends in the profession each extracted tooth which came out with the granuloma or pus sac intact, the relative merits of sodium chloride, zinc chloride and Churchill's tincture of iodin were then tested. The first two named solutions gave no germicidal results possible of detection. Churchill's tincture, however, used for fifteen minutes with either one-half or one milliampere gave approximately a seventy-five per cent germicidal result. Seventy-five per cent was good but not good enough, so the length of the ionization was increased and a uniform current of one-half milliampere was used. The result was very uniformly a complete destruction of bacterial life in all but three of fifty teeth tested—contamination could easily account for the three. The technique of these experiments was as follows: immediately upon obtaining the tooth, it is sent to the bacteriologist who made cultures both from the canals, and from the granuloma or pus sac by means of a minute puncture. The specimen was immediately returned to me, a wax collar sealed about the gingival line, the root portion of the tooth placed in the tube containing Ringer's solution, which tube had a platinum electrode fused in the glass at the bottom. Without removing the debris from the canal Churchill's tincture of iodin was pumped in to the absolute foramen, the electrode placed in the canal in proper position and the current turned on. As stated, fifteen minutes ionization gave approximately 75% result—thirty minutes ionization produced a sterility of both the structure of the tooth and the sac. The specimen was then returned in the tube to the bacteriologist, who removed it, peeled off the granuloma or sac, mascerated it, impregnated various culture media with it and incubated. The apical third of the root was chipped off pulverized and cultured in the same manner. As stated, 47 of 50 cases proved sterile both as to tooth structure and granuloma. The specimens having been destroyed the three which gave positive results could not be retreated. This led to the adoption of thirty minute duration of treatment and one-half milliampere per canal for strength of current.

CLINICAL APPLICATIONS

Clinical Evidence
Testing for Infection

"IN the meantime clinical results were fully supporting the laboratory evidence. Until at the present time records of over 700 pus cases showed approximately 95% result in the immediate stoppage of pus formation which is about the best evidence we can get of the practicality of this treatment. About that time a prominent diagnostician asked me, 'How do you know that you destroy all the infection in these practical cases?' I was compelled to reply that I did not know that such was the case. He somewhat gruffly stated, 'Well, then, you ought to find out.' This aggravating (because perfectly true) remark opened up a new field research. I tested the cases by passing a probe through the canals and in inoculating culture media with it. This proved negative but inconclusive. Evidently some method for aspirating the apical fluids would be necessary, so an Elgin casting machine was obtained, a long non-collapsible tube attached to it which was in turn attached to the tooth in the following manner: 30 gage irridio-platinum was wrapped around fourteen gage wire, slipped off and soldered with pure gold. This was then fused in the end of a glass tube which would fit tightly the rubber tube. By this means a high degree of vacuum could be created and I found by maintaining this vacuum from 5 to 20 minutes, depending on the size of the foramen, I could easily obtain a considerable quantity of the apical fluids. The platinum tube was sealed in the pulp chamber with temporary stopping and held with the braced fingers during aspiration. The fluids were then absorbed from the pulp chamber and canal with sterile cotton pellets and points and placed in various culture media. These were cultured from three days to three weeks. Before treatment, 24 hours was sufficient to give a luxurious growth from infected cases. After treatment in the majority of cases, three weeks culturing showed no growth. I was then in a position to inform my gruff friend that I *did* know that no infection remained after the treatment of a case in the mouth.

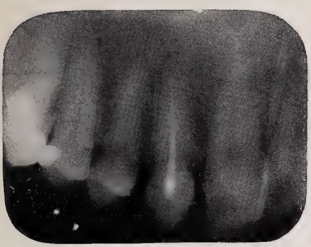
"Laboratory investigation is a valuable thing; it is, however, of very slight value as contrasted with that of clinical evidence. All good laboratory men can do tricks and stunts with their laboratory specimens which cannot be accomplished outside of the laboratory. Furthermore, the fact that certain things can be done or cannot be done in the laboratory is no evidence whatsoever that it can or cannot be done clinically.

"Granting that we could not (which we can) destroy infection in an apical area in the mouth, we should not forget that the body is one of the most hostile mediums to pathogenic bacteria and even if we do not fully destroy the infection, if we attenuate it by fifty to seventy-five per cent in the vast majority of cases, the phagocytic elements of the body could easily account for the remaining non-virulent bacteria.

"By this simple and inexpensive means each dentist may perfectly check up his results and at the same time check the correctness of his technique. In aspirating for culture after treatment, the canals of the tooth must be thoroughly washed with 95% or pure alcohol until it contains no trace of iodin. This must in turn be removed, a prolonged washing of the canals with distilled water, the canal then dried out with pellets and points and the fluids aspirated.

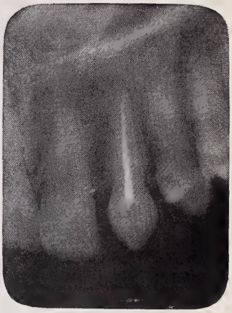
Case Histories

"Probably the most remarkable clinical evidence that I have secured of the effectiveness of this technique is through the treatment of acute periapical abscesses at their most virulent stage. By most virulent stage I mean that stage in which swelling is just beginning, pain most intense, and no defense as yet established by the body and is evidenced by a total absence of pus. One case history of this type will answer for the total of fourteen which I have secured to date at this particular stage. Case: woman, age about 40, not very vigorous physique, general physical condition appears to be good; tooth, upper left first bicuspid, acute per apical abscess; intensely sore to percussion; slight swelling; redness of tissue; complete loss of sleep previous night; the tooth opened, no pus discoverable; canals immediately



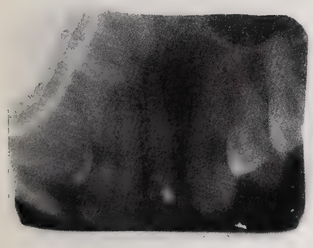
No. 1

Upper left cuspid showing imperfect canal filling and small rarified area at the apex.



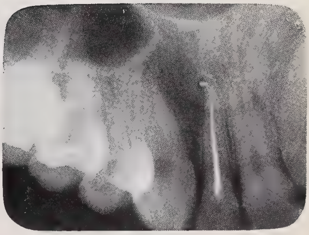
No. 2

Same tooth 18 months after ionization and correct filling showing complete absorption of granuloma and filling in of normal bone.



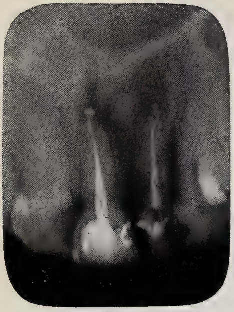
No. 3

Upper right lateral showing large diffused area about the apex with some destruction of septal bone to the distal.



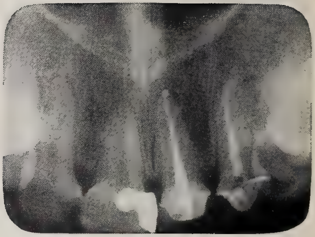
No. 4

Same tooth six months later showing complete regeneration of bone except for small area of scar tissue immediately surrounding the small "button."



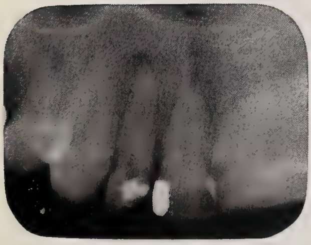
No. 5

Extensive destruction of bone at the apices of upper right central and lateral with infiltration of septal bone.



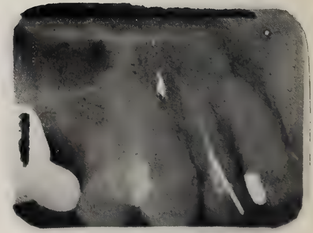
No. 6

Same case 12 *months later showing perfect regeneration and complete restoration to normal.*



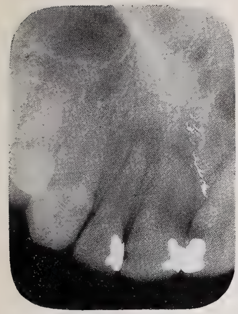
No. 7

Upper left lateral showing typical rarified area.



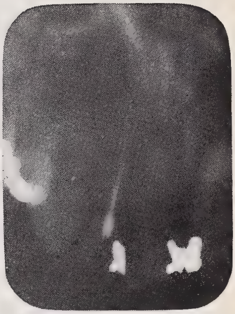
No. 8

Same case one year later showing complete restoration and normal calcification of bone.



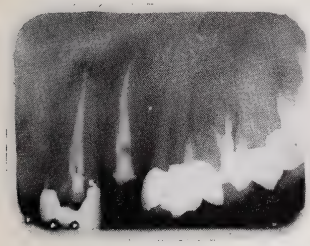
No. 9

Rather large area on upper left lateral apparently approaching upon apex of central.



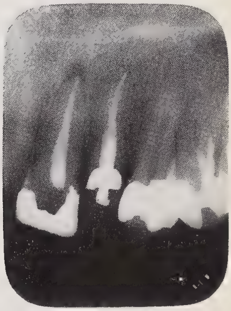
No. 10

Same case 10 *months later showing complete restoration.*



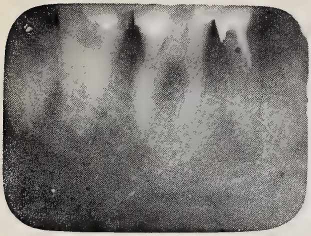
No. 11

Unusually large area involving upper left central and lateral with complete destruction of approximate half of the alveolar septum.



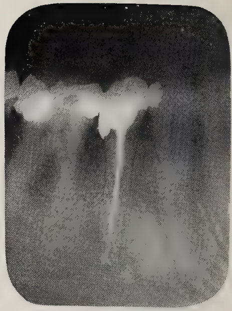
No. 12

Same case 2 years later showing complete regeneration and calcification of area. Small spot of persistent scar tissue at apex of septal.



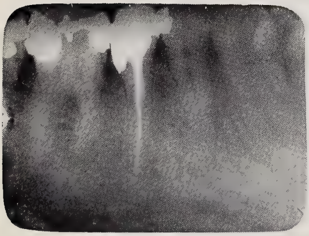
No. 13

Very large diffused area on lower left second bicuspid. (Mental foramen is at apex of first bicuspid.)



No. 14

Slightly different view of same case immediately after ionization and filling. (Note large number of apical foramina).



No. 15

Same case 2 years later showing perfect regeneration and complete restoration to normal.

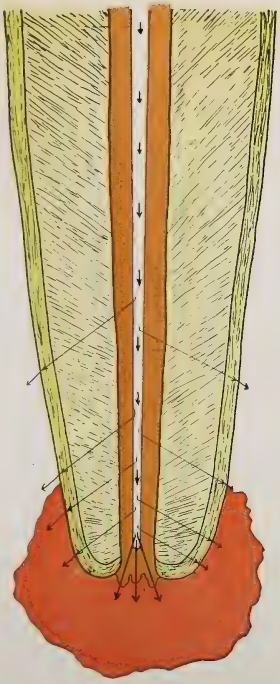
cleaned out, ionized and filled at first sitting about 9 a. m. The following day the patient returned reporting a continual diminution of pain throughout the day, splendid night's sleep and the only evidence of pathology was a slight sensitiveness to percussion. 48 hours after treatment this symptom had entirely disappeared and the tooth was apparently normal in every way. Thirteen other cases treated in identical manner gave practically identical results. Some responded more quickly but in none was there evidence of pathology after 48 hours.

Immediate Root Filling

"Experiments were also made as to whether or not it was advisable to make immediate root filling after ionization. The result of which indicates clearly that such is the case. Numerous cases of known infection were ionized, then washed out and retested, the external opening cemented and left alone for from one to four weeks. In each of these cases upon re-opening and testing at a later date a growth was obtained. The same cases were then again ionized, cultures taken, and the canals filled. These cultures uniformly proved negative. Thirty days later each case was returned to the office, root filling carefully removed with xylol, cultures taken and root refilled. These cultures proved negative. This process was repeated each thirty days from three to four times—each time negative results having been obtained. Bear in mind that these were cases which had been reinfected within one to four weeks after ionization and before filling, but not one of the cases showed the presence of detectable infection at any time during the three to four months subsequent treatment and filling. Therefore, the deduction is that the root should be filled immediately after ionization."

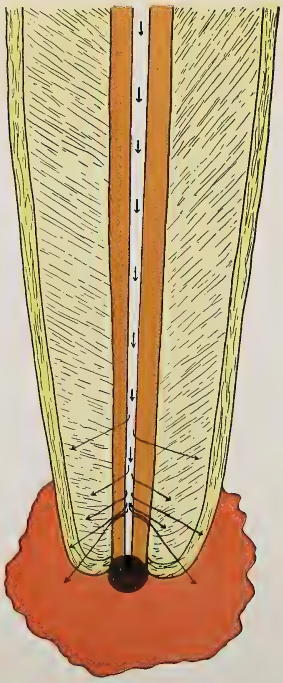
Flat Electrodes

Not the least of the many great advantages of electrolytic medication is that of the ease with which the treatment may be administered and the almost total freedom of pain to the patient. There are, however, numerous small points of technique, each



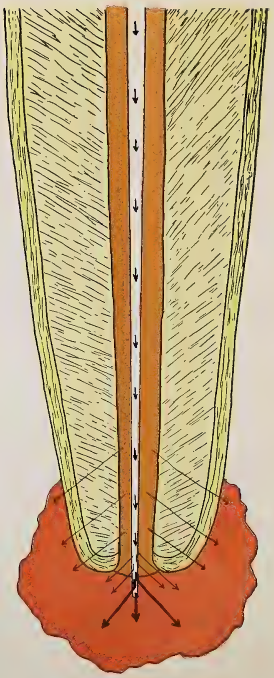
Correct Method

Electrode is shown in correct position and canal entirely filled with electrolyte. Three arrows indicate current passing from electrode, through electrolyte and into tissues.



Incorrect Method

Shows electrode in approximately correct position, but end of it in an air bubble (electrolyte not properly pumped in). Current may flow through side of root but does not carry medicament into infected apical area. Failure.



Incorrect Method

Here the electrode is shown with the point through the foramen. This will cause a short circuit, the current passing into the tissue without conveying the medicament.

of which may in themselves seem trivial to the operator but neglect or lack of care in any one of them may totally defeat the purpose of the treatment.

In the old method, for instance, a round and pointed tooth electrode was used. This will be perfectly effective in the majority of cases but in some cases would defeat the treatment entirely for the following reason: should the canal happen to be perfectly round, the round wire passed into it until it hangs, completely stops it and prevents the diffusion of the fresh iodin contained in the larger portion of the canal to take the place of that driven out of the solution by the electric current, and therefore so little of the iodin will be conveyed as to have no appreciable effect on the apical infection. It is a well-known fact of canal anatomy that however flat the canal may be near the pulp chamber, in the majority of cases it gradually assumes a rounded form as it approaches the apex. The curettment of the canal with various round instruments such as files and broaches tends to still further round the canal. Therefore, it will be seen that we must use a flat electrode so as not to occlude the canal and permit of the ready diffusion of the fresh solution as the solution beyond the electrode is exhausted of its active ingredient. Failure to do this will produce total failure of the treatment in many cases where otherwise it might succeed perfectly.

The electrode wire may be of any desired metal inasmuch as the metal itself is not attached to any marked degree to the iodin due to the fact that the iodin is flowing away from the electrode instead of toward it. Zinc, or copper, or even steel, works very well for this purpose but the best material is irridio-platinum. For this purpose the 30 gauge wire containing 10% irridium may be used, flattening one end on the anvil and pointing and shaping it with a sand paper disc. Various sizes should be available to properly fit any canal.

Placing Electrodes

Another very important point is that the tooth electrode should neither pass through the foramen nor be placed too far from it. Experiments prove that the end of the electrode should be approximately one-eighth to one-sixteenth inch from the foramen (see page 20). Should the point pass through the foramen, it will short circuit on the apical tissue and the current following the line of least resistance will pass directly from the point into the tissue without conveying practically any of the medicament. Should the point be placed too far from the foramen (one quarter of an inch) the line of least resistance might be through the *side* of the root. (This is especially true in the flattened roots.) Therefore, again we would have a ready flow of current as shown by the milliammeter and resistance gauge but would have practically no medication of the infected apical tissue. It is often necessary to especially fit the electrode to each canal before giving the treatment. A piece of 36 gauge sheet platinum handy will often enable you to quickly cut a correctly sized electrode with little loss of time and material. It is not advisable to hold electrodes in the canal by packing cotton around them as this also interferes with the ready diffusion of the fresh solution to the point of activity. It is best to have the point electrode of such a size that it will bind tightly into the canal at the proper point and be entirely self retaining.

Renewing Solution

It is generally necessary to renew the solution several times during the treatment (this is especially true in the small canals.) When the level of the solution sinks below the floor of the pulp chamber fresh solution should be added, then by grasping the electrode with the fingers or pliers pump the fresh solution deeply into the canal. This may be done without discontinuing the treatment. In the anteriors it will often be noticed that in from five to ten minutes of treatment, the solution in the tooth becomes practically colorless. Absorb all the solution with a cotton point, refill with fresh solution and continue the treatment as directed. In the multirooted teeth two or more canals may often be treated simultaneously if the foramina are of practically the same size. Theoretically it would seem better to ionize each canal separately. Clinically and experimentally, results are just as good where two or more are treated simultaneously as stated above. Where there is a marked difference in the size of the foramina, as for example, that existing between the buccal and platal roots of an upper molar and the mesial distal roots of a lower molar, the two smaller canals generally have foramina of approximately the same size and may therefore be ionized simultaneously, and a separate ionization given for the palatal or distal root with the large foramen. The electric current follows the line of least resistance and the size of the foramen is the principle factor in this resistance.

Attaching Electrodes

A very convenient and simple way of attaching two or more electrodes is to bend one of the "blunt spring socket copper needles" (see page 32) into fish hook form, then bend the blunt ends of your electrodes into eyelet form so that the copper hook may be passed through and connected with as many electrodes as desired. The flexible holder (see page 31) is much more convenient and easier used for tooth medication and being very light does not tend to draw the electrodes from the tooth as is the case with the chuck form of holder. The "spring cheek electrode" (see page 31) is far superior to the "face electrode" (see page 32) for this treatment in that it can be placed close to the apex of the tooth, thereby diminishing tissue resistance to the current and proving much more comfortable to the patient."

Negative Electrode in Tooth for Iodin Ionization

Iodin being an electro-negative element, the *negative* electrode must be placed *in the tooth* and the positive on the cheek when any solution of iodin is used.

PYORRHEA TREATMENT

In pyorrhea pockets, after thoroughly scaling, wrap a flat zinc electrode with a little piece of cotton saturated with a 3 per cent solution of zinc chloride, introduce it into the pocket and then treat in the usual way, running up the current to two milliamperes, or three if the patient will allow it. Keep the current on from five minutes to fifteen minutes. If scaling is difficult treat first with Lugol's solution which may be obtained from druggists and consists of five parts of iodin crystals, ten parts potassium iodide, one hundred parts water, by weight. Then follow at the next sitting with zinc or copper treatment. It will be found that in the interim the gums have receded so the deposits can be easily removed. As it is impossible to insulate the tooth as in root canal work, care must be taken that the current is not diverted as a result of flooding with solution.

A copper electrode may also be used with a 2 per cent copper sulphate solution. In bleeding gum conditions copper-ions are very desirable. If pocket is restricted so it is difficult to use the electrode wrapped with cotton, use it bare.

If there is any tendency for the copper electrode to adhere to the tissues, reverse the polarity of the current for a few seconds before removing it, as explained under heading "Alveolar Fistula," which just follows.

Three or four treatments may be required and tests should be made the same as suggested under heading "Abscess Treatments." Dr. Fette suggests the use of iodin-ions also in treating pyorrhea conditions when there is much inflammation, otherwise zinc or copper should be used. He says: "I use the iodin-ions sparingly and only where there is considerable inflammation and pain." He recommends the use of Lugol's solution as already explained.

Tincture of iodine is not an electrolyte and therefore is of no value.

Important—When using the above solution, namely, iodin-ions, the negative pole must be applied to the part undergoing treatment, for iodin-ions are electro-negative and will therefore be repelled from the negative pole into the tissues.

In pyorrhea treatments, on account of a little difficulty in getting enough solution into the pockets without flooding, it may be necessary to renew the solution during a treatment.

To do this Dr. Fette suggests a very ingenious method by which this can be done quickly. Instead of returning the current regulator to zero, slide the electrode to the tip of the tooth gradually and then remove it. Replenish the solution on the needle then apply it at the tip and slide it gradually into the pocket again.

ALVEOLAR FISTULA

A copper electrode is recommended for this with a 2 per cent copper sulphate solution, and the electrode should be placed along the whole tract to the source of the trouble. After a current of from 2 to 4 milliamperes has passed for five minutes, it will be found that the electrode has adhered to the soft tissue. Reduce the current to zero by returning the Regulator button (see page 27), 30 and reverse the plug connector which enters the regulator case on the side marked "Patient Circuit." Do not reverse the other plug. Then apply the current again and keep it on for a few seconds when it will be found that the copper electrode can be easily withdrawn.

Following this treatment the fistula should be treated through the canal either with zinc or copper ions.

Dr. Fette states in regard to fistula treatments, that, "while zinc-ions are a little better than copper-ions, I prefer the latter on account of their coloring the tissues blue, in depth proportionately to the current and time, which helps me as a guide. In treating a fistula I insert a copper electrode (bare or wrapped with its solution) to the end of the tract and then treat with 2 to 3 milliamperes for five minutes. At the subsequent sitting, if the fistula is healed, I treat the root canal, otherwise treat fistula again. Three to four treatments should be sufficient."

OEDEMATOUS CONDITIONS

In treating these conditions about the mouth, Dr. Fette has obtained excellent results by using Dr. Martin Fischer's salt solution (4 or 5 per cent. magnesium sulphate) and applying it with a sponge or felt electrode to the positive pole of the current. A flat, smooth piece of sponge or several thicknesses of felt should be used, saturate this with the solution and place over it a piece of zinc or copper gauze, to which the positive pole must be connected, and then apply the current as usual, using about 3 to 10 milli-amperes, depending on the electrode surface. Be sure no part of the metal touches the bare skin. The felt or sponge electrode may be held in place by means of a rubber dam holder.

Instead of the sponge electrode, the special face electrode which we furnish, shown on page 33, may be used, which the the operator must hold in the hand. Saturate the felt thoroughly with the Fischer solution.

The Fischer solution that Dr. Fette recommends is a 4 or 5 per cent solution of Magnesium Sulphate.

In reference to the results obtained by these treatments, we will quote from Dr. Fette's article in the Journal of the National Dental Association:

> "The one successful and rapid means of relieving those troublesome swellings about the gums which are so vexing to the dentist, and so painful to the patient, would amply justify the practitioner in familiarizing himself with the principles and technic of electrolytic medication."

If the gums are highly inflamed and swollen, the rubber cup electrode, illustrated on page 32 we furnish should be applied, by holding it firmly against the part to be treated after filling the cup with cotton saturated with the magnesium sulphate solution, and connect with the positive pole.

After filling root canals, if the patient complains of soreness, this may be relieved by treating the gums with magnesium sulphate solution, using the cup electrode shown on page 31.

PRURITUS ANI AND OTHER INFLAMMATORY CONDITIONS

Considerable experimental work along these lines has been conducted by William A. Rolfe, M. D., 330 Dartmouth St., Boston, Mass. Dr. Rolfe is connected with the Boston Dispensary and has reported most of his work with Electrolytic Medication in the Boston Medical and Surgical Journal published at 126 Massachusetts Ave., Boston, Mass.

PULP TESTER

The ionization instrument, or current regulator, may also be used for determining the vitality of pulps of teeth by proceeding as follows:

Place the cheek clamp electrode in the mouth the same as explained in the directions on Ionization, excepting it is unnecessary to wrap it with bibulous paper. Attach the green cord as usual and with the electrode attached to the red cord by means of pencil like holder, touch the teeth to be tested. The Ionization Regulator button should be on the zero position to start with, then it must be advance gradually until the tooth responds. It is not necessary to hold the electrode in constant contact with the tooth, as in Ionization treatments, in fact it is better to make and break the current by means of the electrode. Keep advancing the Regulator button until the patient experiences a slight shock, which indicates that the tooth under test is alive. Should you fail to get any response after going to the highest point on the scale, then it is quite certain that the pulp is devitalized.

EQUIPMENT

Ritter Portable Ionization Equipment

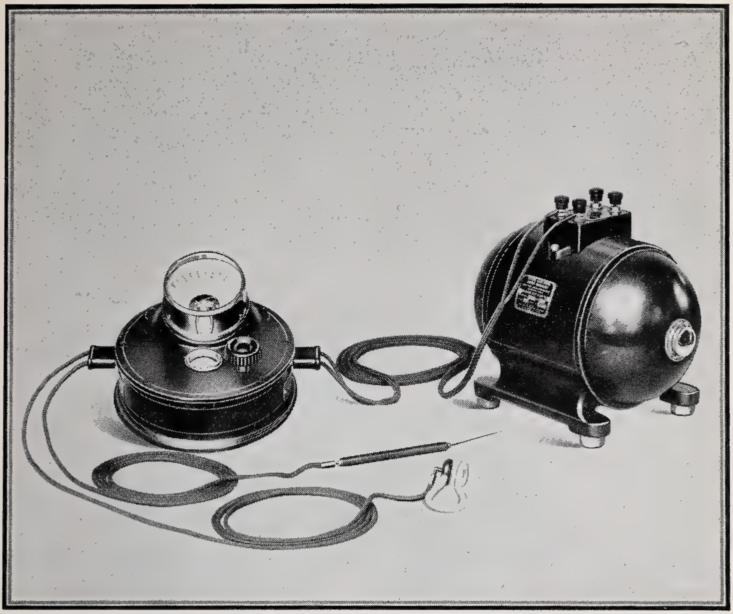
TO further the study and practice of Electrolytic Medication we have perfected an equipment that meets the requirements of the most exacting practitioners. It consists essentially of two Units: a motor generator or motor transformer as the case may be for reducing the supply current to the low voltage required for performing the work, and a current regulator for controlling the electric current applied to patients.

The function of an Ionization instrument or current regulator is to apply electric current gradually without the slightest interruption, variation or break in the flow of current and to register the exact amount of current being applied. The Ritter Ionization Current Regulator was designed particularly with this object in view and the degree of subdivision of the regulating resistance has been carried out to such an extent that the change in current strength between the divisions is not perceptible in even the most delicate operations.

The gradual application of the current is accomplished by turning the hand knob shown on the top of the regulator. The graduated dial beside the hand knob is provided for the purpose of assisting the operator to intelligently use the instrument. The dial has no particular bearing on the use of the equipment except that it indicates to what extent the regulating resistance has been passed over. The dial is divided into one hundred divisions and if fifty divisions have been passed over when a treatment is finished it merely indicates that one-half of the resistance has been cut out of the patient's circuit. It does not give a reading in volts, but is simply an arbitrarily chosen scale to assist in the use of the instrument.

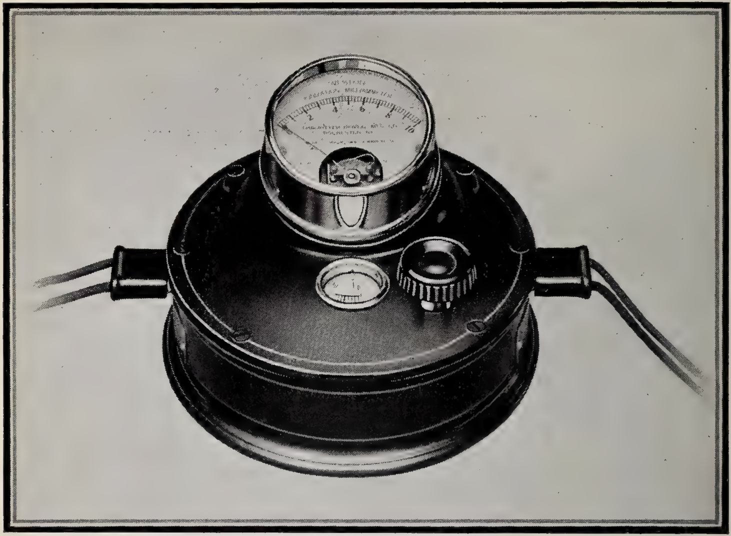
The milliampere or current meter shown at the back of the regulator registers the amount of current being applied to the patient.

The current indicator has a range as from zero to ten milliamperes with divisions readable in 1/20 of a milliampere. It



Ritter Portable Ionization Equipment

Illustration shows complete equipment, consisting of current regulator, motor generator for alternating current or motor transformer for direct current; face, cheek and cup electrodes; flexible and standard needle holders; one double connecting cord for regulator and generator or transformer connection; one pair of single connecting cords for regulator electrode and needle holder connection; and 36 assorted zinc and copper, taper, blunt and flat wire needles.



Ionization Regulator

not only indicates the flow but also measures it accurately. A correcting device is provided so that the needle can be adjusted so that it will always rest at zero when no current is flowing.

The regulator may be placed in a convenient location either on a small stand beside the chair or on the bracket table. Two cords are furnished; one for making the connection between the generator or transformer and the regulator, and the other for attaching the electrode and needle holder for the patient connection to the regulator.

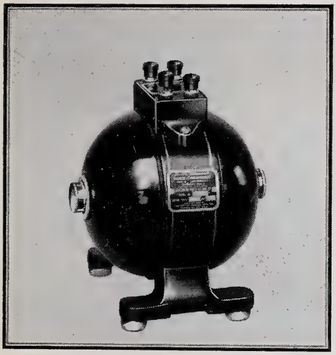
The current regulator is finished in mahogany with polished nickel trimmings. It has a felt covered base to prevent marring any surface that it might come in contact with, is convenient to handle and weighs only 2½ pounds.

Generator or Transformer

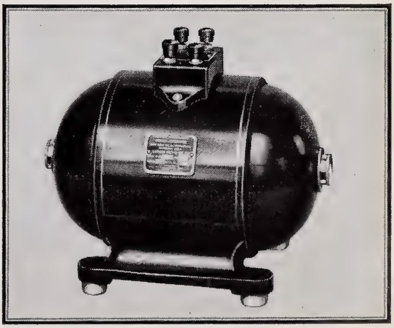
Only an electric current flowing constantly in one direction of not more than forty volts is suitable for ionization work, therefore, the ordinary lighting current cannot be used without reducing it to a lower voltage.

For 110 or 220 volts, direct current, a motor transformer is supplied with the equipment to transform the high voltage to the low current required. On 110 or 220 volts, alternating current, a motor generator is furnished to generate the necessary voltage.

By using the generator or transformer there is absolutely no danger or possibility of shock to either the patient or the operator, as the electric energy flowing in the patient circuit is produced through magnetic induction, there being no actual electrical connection between the main supply current and the patient current.


TRANSFORMER

The motor transformer and motor generator are of Ritter construction, efficient and practically noiseless in operator and are completely enclosed in dust-proof cases. They may be located in any convenient place such as a stand beside the cabinet or even in the laboratory. In the latter case it would be necessary to run a cable from the transformer or generator to a plug in the operating room located a suitable distance from the chair.


GENERATOR

Electrodes

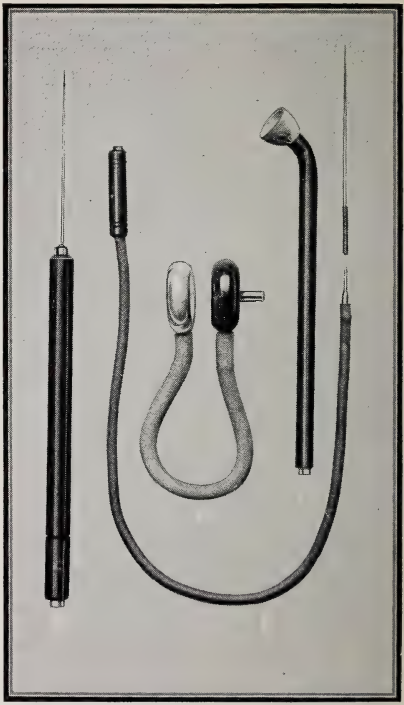
CHEEK ELECTRODE

The Ritter Cheek Electrode, shown on page 31, is highly recommended by operators who have used this improved type of electrode. They claim that the patient never complains of the tingling sensation which always seem to be present with the sponge electrode fastened to the face or wrist, and on this account, the current can be raised to the maximum "Irritation Point" much quicker.

The horseshoe-shaped spring is of the best phosphor bronze and is covered with a renewable rubber tubing. A plate is threaded on either end of the spring, one being aluminum for patient contact, and the other an insulated plate in which a socket is inserted for the current connection.

Cup Electrode

The Ritter Cup Electrode, as illustrated, is also supplied. This is used advantageously in treating the gums to alleviate any soreness which may be present after filling root canals. It consists of a hard rubber handle with socket for conductor connection and a pliable rubber cup that is renewable.



Electrodes

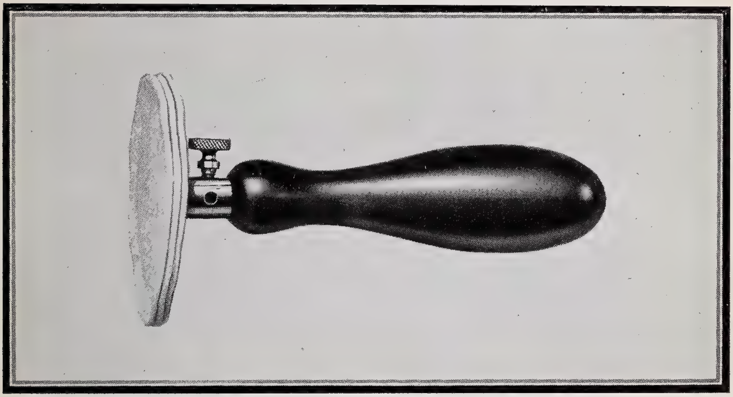
A—Cheek Electrode
B—Flexible Wire Needle Holder
C—Cup Electrode
D—Standard Needle Holder

Needle Holders

The wire needles used in electrolytic medication treatment fit into a pencil-like holder shown in the reproduction above. The holder being of a small size it can be easily balanced in the hand or laid in the mouth of the patient on a rubber dam if preferred. A flexible holder is also provided as illustrated for the special spring socket wire needle shown by figure.

FACE ELECTRODE

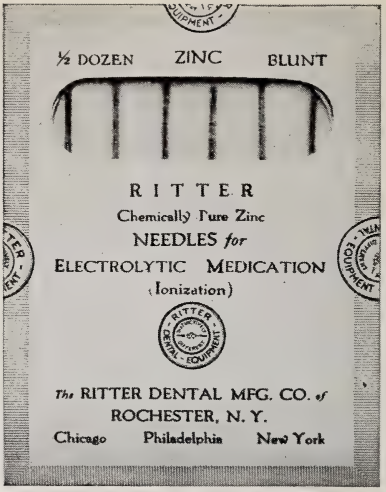
The face electrode, as illustrated below, is furnished to be used particularly as an active electrode in the treatment of inflamed nerve tissues of the face. It is provided with a mahogany finished wooden handle of convenient size and the plate is covered with three thicknesses of all wool felt which can be easily replaced should it ever be necessary. The current connection is made at the base of the handle by the means of a knurled thumb screw.



FACE ELECTRODE

Wire Needles

An assortment of thirty-six zinc and copper taper, blunt and flat wire needles adapted to meet all conditions, are furnished with the equipment. As it is advisable to always use electrodes with the largest possible cross section or size in order to reduce the current density per given area, the needles may be easily shortened by cutting or filing until a correct size or diameter is obtained.



Ritter Ionization Needle Pack

If zinc needles are used they should be chemically pure zinc. If they contain arsenic or antimony serious results will follow. Therefore, ordinary commercial zinc should not be used under any circumstances. Ritter wire needles in zinc or copper, packed in boxes of six, and special spring socket needles in books of six can be secured from dental dealers.

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